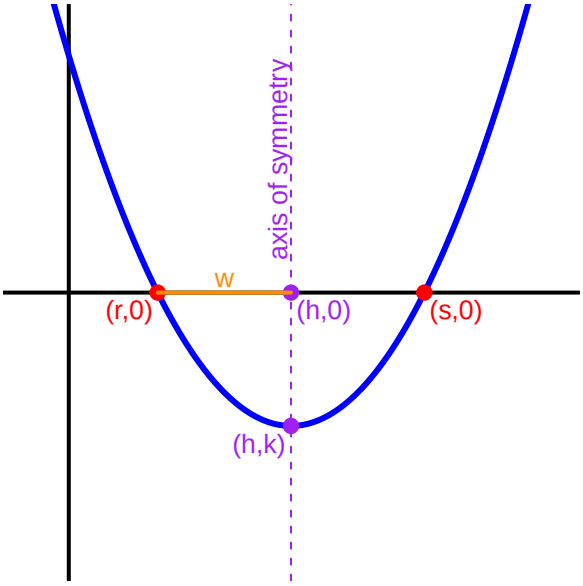
Quadratic parameters

A quadratic function represents a parabola with a vertical axis of symmetry. The vertex is at point (h, k) and the axis of symmetry is the line $x = h$.

If the parabola crosses the x axis, there will be two x-intercepts (also called roots or zeros) at $(r, 0)$ and $(s, 0)$. Those two roots will be equally far from the axis of symmetry, and we can call that distance w.



The same quadratic function can be expressed in multiple ways:

$$\begin{aligned} \text{Standard:} \quad & y = ax^2 + bx + c \\ \text{Vertex:} \quad & y = a(x-h)^2 + k \\ \text{Factored:} \quad & y = a(x-r)(x-s) \end{aligned}$$

It is possible prove the following formulas:

$$h = \frac{-b}{2a} = \frac{r+s}{2}$$

$$w = \left| \frac{\sqrt{b^2-4ac}}{2a} \right| = \frac{|s-r|}{2}$$

$$k = ah^2 + bh + c = \frac{4ac-b^2}{4a}$$

$$r = h - w = \frac{-b-\sqrt{b^2-4ac}}{2a}$$

$$s = h + w = \frac{-b+\sqrt{b^2-4ac}}{2a}$$